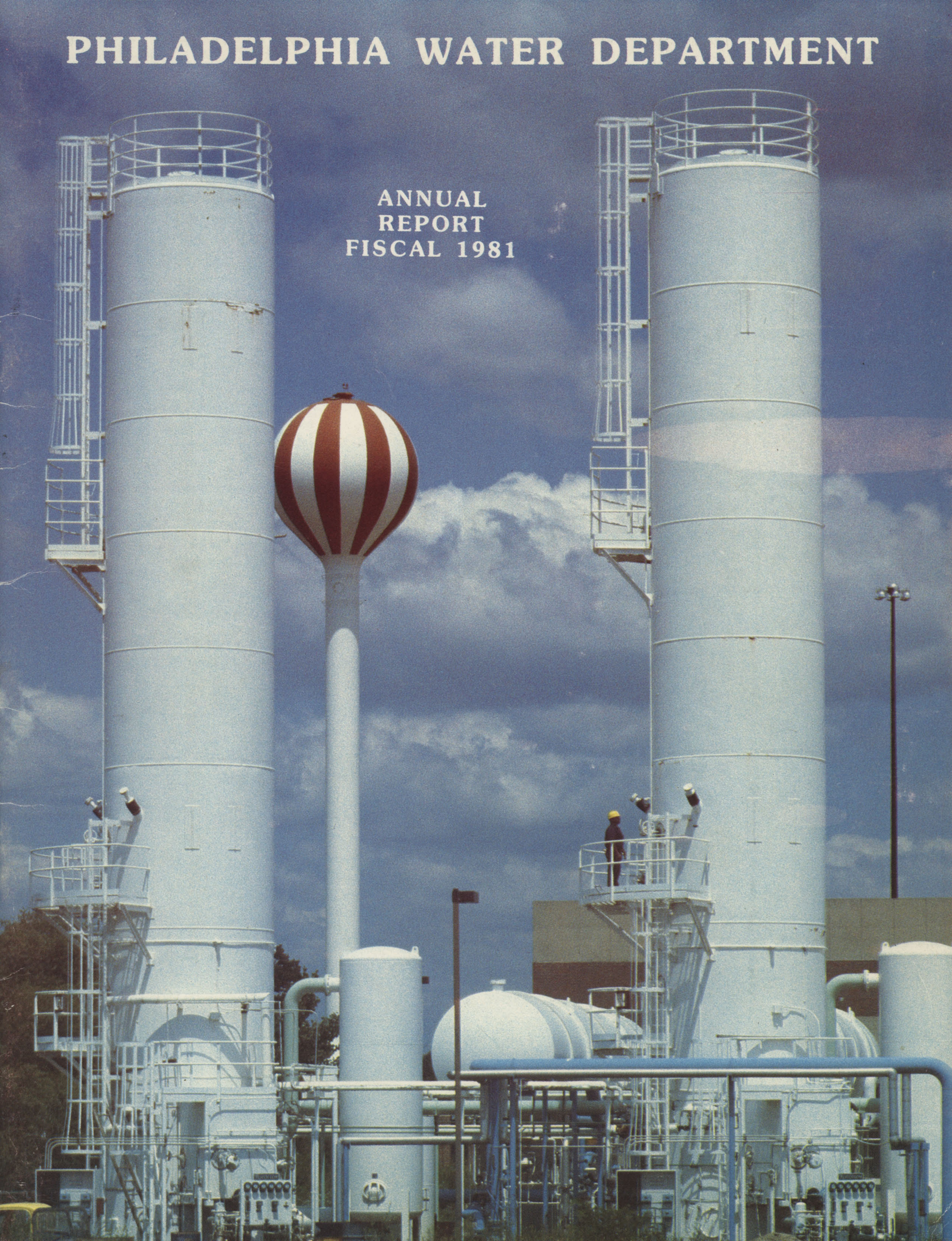

PHILADELPHIA WATER DEPARTMENT
ANNUAL
REPORT
FISCAL 1981



Contents

Highlights of Fiscal 1981

A Move Toward Utility Management

New Management Philosophy

Beginning in Fiscal 1981, a new management philosophy was adopted to run the Water Department more like a utility and to balance services against costs and revenues. This approach, in response to the major increase in the department's ability to achieve higher levels of wastewater treatment, assures tighter control of any corresponding rise in expenses and revenue requirements.

To balance resource needs and controls against plans and objectives, a "Zero Base" Operating Budget was prepared. In addition, a computerized budgetary accounting system was established to enable managers to review accountability at both the Division and Responsibility Center level.

Studies were made to:

- Establish base services.
- Identify desirable increases in standard of services.
- Assess productivity of functional areas.
- Evaluate reductions in base needs.
- Identify additional sources of revenue.
- Pursue capital improvements which would minimize operating costs.

Restructuring the Organization

Several important modifications to the organizational structure were made this past fiscal year. The principal objectives in this reorganization were to eliminate duplication of technical functions, to broaden the department's ability to function as a utility with good financial standing, and to lower the unit price of delivering services.

As a first step in accomplishing these objectives, Research and Development was reorganized into the Planning and Technical Services Division in March of 1981. A centralized laboratory section was established within this new division under a Director of Laboratory Services. This meant that for the first time, the Material Testing Laboratory, the Organic Research Laboratory, six process control laboratory areas, and four quality control laboratory areas from the Water Treatment and Water Pollution Control Plants were all centralized under a Director of Laboratory Services.

The third major change made to improve efficiency and coordination of their work was to transfer a majority of functions performed by the Interceptor Group of the Water Pollution Treatment Section to the Collector System.

William J. Green
Mayor

W. Wilson Goode
Managing Director

William J. Marrazzo
Water Commissioner

Analyzing Construction

In Fiscal 1981, our construction program reached over $227 million, $86 million more than the previous year. Of that total, $140 million represented inflation as measured in 1970 dollars.

By far, the largest part of the Capital Program, $194 million was spent on expanding and upgrading the Northeast and Southeast Water Pollution Control Plants to comply with federal and state requirements. The new Southwest Water Pollution Control Plant, about 75% complete at a cost of $224 million, was officially dedicated on October 15, 1980.

In the replacement category, over $10 million was spent on sewers and almost $7 million for new water mains. Other major areas were $9 million for storm flood relief and $4.2 million for filtered water storage.



Financing Capital Improvements

To support the construction program, preparations were begun in the Spring of 1981 for the issuance of $125 million of Water and Sewer Revenue Bonds, Seventh Series, early in Fiscal 1982.

The department also initiated a review of the Capital Improvement Program, examining each project to identify those which could be reduced in scope or eliminated without materially affecting the quality of water and wastewater services. As a result of this analysis, the capital expenditures for Fiscal Year 1983 Capital Improvement Program are expected to be substantially smaller than were included for such years in the Fiscal 1982-1987 Capital Improvement Program.

Rate Increase

In February, 1981, City Council was notified of the Water Department's proposed changes in water and sewer rates to be effective on July 1, 1981. The increase was to keep the department self supporting, as required by City Charter. Without the increase, it had been projected that there would be revenue deficiency of $34.4 million in the Water Fund and $56.5 million in the Sewer Fund over the next two fiscal years.

Principal and interest payments on bonds to finance major capital additions such as the expansion and upgrading of our sewage treatment plants was the major reason for the rate increase. About 35% of the increased charges were due to this debt service, 14% to salaries and wages, 12% to energy and 6% to disposal of sewage sludge.

When the proposed rates were filed with the Records Department, an extended public participation process, including meetings with civic groups, was conducted. Finally, after holding a series of public hearings before an independent Hearing Examiner, the Water Commissioner approved an average increase of 44% in the water and sewer rates.

For the first time in many years, the department increased the special water rates for certain charity customers such as schools, churches, synagogues, and other miscellaneous institutions to 25% of the regular water charges. In addition, qualified Senior Citizens, 65 years and older, received the same 44% increase as everyone else, but this still represented a 67% discount from regular rates. The income test to determine eligibility was delayed until July 1, 1982, when the senior citizen rates will be raised to 50% of the general water and sewer rates.

Each of the 8 new sludge digestion tanks built at the Southwest Plant is circular with a fixed cover and has an internal volume of over 2 million gallons.

The 1980-81 Drought

The four state Delaware River Basin region—that takes in eastern Pennsylvania including the Philadelphia metropolitan area, western New Jersey, most of Delaware, and part of the Catskill Mountains in New York—quickly experienced a serious water shortage during the summer and fall of 1980 because of far less than normal precipitation. On November 6, 1980, the Water Commissioner announced a voluntary water conservation plan and on January 15, 1981, Mayor William J. Green made these conservation measures mandatory.

Philadelphia draws its water from the Schuylkill and Delaware Rivers in approximately equal quantities. A 30% rainfall deficit from May 1980 to January 1981 lowered the flow in the Delaware River and necessitated greater than normal releases of water from the New York City reservoirs to protect downstream users like Philadelphia. These reservoirs, which have a capacity of 271 billion gallons, were drawn down to 30% in early 1981.

After declarations of a water supply emergency in January, 1981, by the Delaware River Basin Commission and Pennsylvania's Governor, Mayor William J. Green announced a Drought Water Emergency Plan on February 11, 1981. The plan prohibited non-essential uses such as watering lawns and gardens, washing cars, and using fire hydrants except for fire fighting.

The public's cooperation in conserving water and the drastic decrease in illegally opened fire hydrants contributed to a 5% decrease in water consumption.

Water Conservation

In cooperation with the Mayor's Press Office, the Philadelphia Chamber of Commerce, the School District of Philadelphia, a Water Conservation Public Relations Program was developed. Using the theme "Water is the Lifeline of the Delaware Valley—Don't Waste It," car cards were installed in SEPTA vehicles, posters on City trucks, and billboards were placed at key locations. Radio and television public service spot messages were also prepared for the media.

Over 260,000 water waste questionnaires and Official Water Detective buttons were distributed to both public and parochial school children. A speakers bureau was established to provide speakers on water conservation and the drought to schools and community groups.

A keystone to the entire program was the sale of over 32,000 water conservation kits for 50¢ each at five departmental locations throughout the City.

End of Ocean Dumping

On November 26, 1980, Philadelphia became the first major city in the United States to stop dumping sewage sludge into the Atlantic Ocean. This was one month ahead of the deadline imposed on the City by a 1979 consent decree signed with the Environmental Protection Agency and one year ahead of the 1981 national deadline set by Congress.

The 70,000 dry tons of sludge generated annually by the three sewage treatment plants will now be used to reclaim strip mined land in southwestern Pennsylvania, applied to farm and park lands, given away as a soil conditioner and used in combination with incinerated solid waste residue to make highway construction aggregate.



The composted sludge is screened to remove the bulking agent (wood chips) which is reused.



Sludge cake is combined with wood chips and composted in piles, using the forced aeration compost method.

The Water System

Treatment and Pumping

Philadelphians consumed an average of 343 million gallons daily (MGD) during Fiscal 1981, only 2 MGD less than the previous year. Another 12.7 MGD was pumped and sold to the Bucks County Water and Sewer Authority.

Fortunately, the water treatment plants had no difficulty in meeting this demand. Their rated capacity (480 MGD) was well in excess of public requirements, and their total peak capacity (681 MGD) easily met high hourly and summertime rates. This was readily apparent on July 21, 1980 during a heat wave, when a new water consumption record of 596.6 MGD was set.

The storage capacity of water system is 806.1 million gallons. As of June 30, 1981, the distribution system served about 515,649 customers through 3,270 miles of mains and provided public fire protection through approximately 26,783 fire hydrants.

This fiscal year, water quality remained excellent, with all parameters meeting the Interim Primary Drinking Water Standards issued by the Environmental Protection Agency on June 24, 1977.

The 1980-81 drought had two significant effects on the water system. First, although water quality was very good, low river flows did periodically increase pollutant levels and odor intensities necessitating additional chemical treatment at increased costs. After the above average rains in February, 1981 and subsequently throughout the Spring, most water quality parameters returned to normal.

Second, stricter controls on unauthorized use of fire hydrants and the public cooperation towards water conservation contributed to a marked reduction in the ratio of peak to average water consumption for last quarter of Fiscal 1981.



Water Quality

The paramount concern of the Philadelphia Water Department is that the water furnished to its customers is healthful and free of contamination. To achieve this goal, the department took the following steps:

1. In 1976, Philadelphia became the first American city to build a pilot plant to determine the best methods for removing trace organics, tastes and odors from water. Located in the Torresdale plant, the pilot facility used both regular treatment and non-conventional treatment such as carbon filters, ozone, polyelectrolytes, and macroreticular resins. A Trace Organics Laboratory was also built at Torresdale to monitor the results of the tests.

2. To protect drinking water from taste and odor causing algae, the department began to cover its open reservoirs. In 1975-76, it placed floating covers on the north and south basins of the Oak Lane Reservoirs, and in 1981, the department's contractor began installing 4 million square feet of synthetic rubber liner and reinforced nylon cover for the north basins of the East Park Reservoirs. When completed, this will be one of the largest municipal lining/cover sites in the world.

3. It reduced the level of trihalomethanes in the finished water by changing the chlorination points in all three plants. Trihalomethanes (THM) are formed when natural and man-made organic materials in water combine with the chlorine many utilities use to disinfect drinking water. Chloroform, the major component of THMs, is said to be carcinogenic to animals in very large doses. For this reason, in 1979, the U.S. Environmental Protection Agency (EPA) set a Maximum Contaminant level for total THM in drinking water.

The Philadelphia Water Department, in anticipation of the EPA regulation, had been conducting research since 1978 to reduce the level of THM in its finished water. By changing the chlorine application points, the department has reduced the total THM level well below the maximum contaminant level established by federal regulations.

Stainless steel impeller for 60 MGD pump pulled for routine maintenance is inspected.

Other Improvements to Water Facilities

1. Improved water quality in the two Somerton steel water tanks by replacing the worn bitumastic lining with a $300,000 epoxy lining.

2. Replaced a 30 MGD, 2,000 horsepower pump at the Belmont Raw Water Pumping Station at a cost of $654,500.

3. Replaced valves and cleaned and lined over 41,000 feet of water mains ranging in size from 20 to 48 inches. These contracts, which total $3.1 million, improved water flow, restored carrying capacity, and reduced water discoloration.

4. Completed 40 contracts to replace aging water mains at a cost of $3.5 million during Fiscal 1981. Another 23 contracts for relays of water mains worth $5.8 million were still active at the end of the year.

Energy Savings

"Demand rates" are set by electrical companies based on the maximum half-hour electrical usage at each facility. To save on electric bills, the department took steps to optimize the operation of the entire system—pumping stations, raw water basin elevations, reservoir and tank levels to minimize the unit cost of power.

The primary way this demand electric rate has been reduced is by going off-peak pumping at Queen Lane Raw Water and High Service Pumping Stations and also at the Belmont Raw Water Station. Preliminary estimates indicate that about $258,000 was saved in Fiscal 1981 by off-peak pumping.

Increased Treatment Costs

Inflation affected the chemical as well as the electrical costs of treating water. The cost of chemicals per million gallons of water treated rose to an all time high. Part of this increase was due to additional use of carbon and sodium chlorite.

Chemical costs including reservoir re-treatment averaged $27.12 per million gallons compared to $20.73 per million gallons in 1980.

Water System Maintenance

Despite a shortage of personnel, Distribution crews met the constant challenge of maintenance problems in winter's cold and summer's heat. In Fiscal 1981, they repaired 1,176 leaking water mains compared to 814 the year before.

Fifteen straight days subfreezing temperatures beginning on December 14, 1980 caused extreme operating problems for repair crews. The thermometer dropped to 1°F. on Christmas, 6°F. on December 26, and 14°F. on December 27.

To combat the problem of hundreds of fire hydrants being illegally opened on hot summer days, they installed a record 4,470 locking devices. This, combined with stricter enforcement and increased public awareness of the drought, drastically decreased unauthorized openings of hydrants in Fiscal 1981.

Although a major break of a 30 inch water main at Kensington and Allegheny Avenues on July 27, 1980 caused flash flooding and considerable property damages, normal service was restored within a few hours.

Over 30,000 delinquent water/sewer accounts were serviced, 7559 services shut off and $1,288,100 collected by the special crews.

Among the thousands of jobs performed by the distribution crews were:

	FY 1981	FY 1980
Water Mains Repaired	1,176	814
Ferrules:		
Installed	3,828	4,042
Drawn or Shut Off		
Pipeline Valves:		
Inspected	17,349	20,795
Repaired	2,830	2,758
Installed	151	159
Fire Hydrants:		
Inspected	30,024	24,863
Repaired	13,237	11,741
Renewed	177	205
Installed First Time	6	7
Valve Chambers Built or Rebuilt	13	19
Fire and Supply Connections Made	127	118
Complaints Investigated	20,709	17,367
Water Services:		
Shut Off for Delinquency	7,559	7,778
Restored	5,905	6,507
Reinspected	75	16
Excavated	3,890	933

24 Hour Service for the Customer

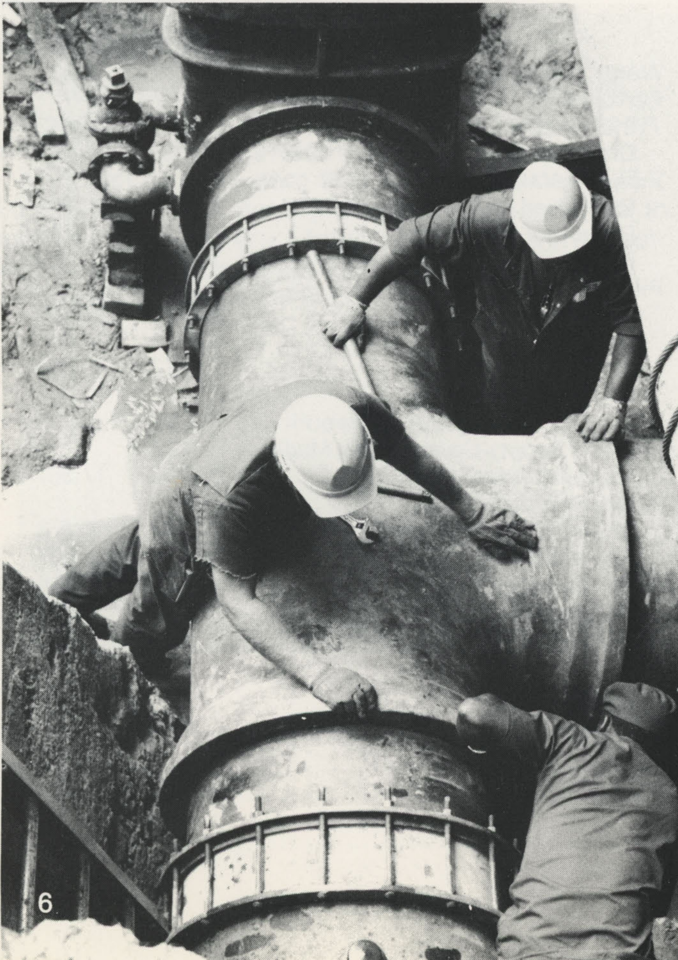
For the departments interviewers, service to the customer was a daily fact. They received 141,300 telephone calls, requesting for information or assistance.

The calls concerned many urgent problems, including broken mains, open fire hydrants, clogged inlets, low water pressure, and ruptured sewers. In response to these calls, Customer Service radioed over nearly 11,000 complaints to mobile field representatives.

During the year, the inspectors performed 88,600 investigations covering permits, billings, leaks, missing meters, and plumber's work. Over 10,400 plumbing violation notices were served to owners to make the necessary repairs. In most instances, owners corrected the cited conditions, and only 57 cases were taken to court.

Many customers on welfare, however, were unable to pay for plumbers. In 337 such cases, the repairs were made for $216,400 and the cost billed to the customer.

Under a small claims ordinance administered by the Water Department, 98 claims against the City for damages from broken water mains and sewers were settled for $43,800.



Repairs are completed to the 30 inch water main that broke on July 27, 1980 at Kensington And Allegheny Avenues.

Maintenance

Automotive

Last Fiscal Year, the Department was making plans to erect a new Automotive Garage to replace the small, outmoded garage located on Logan Street. It planned to build the new garage on Fox Street, not far from the Queen Lane Water Treatment Plant.

During the year, the Automotive Maintenance Section performed over 20,500 job operations, including repairs and services to vehicles, preventative maintenance, state inspections, and repairs to off-the-road equipment.

Building and Plant

Employees of Building Maintenance performed over 1,750 jobs at the treatment plants, pumping stations, and headquarters building. Major repairs included repairs to heating boilers and heat exchangers at Torresdale and the installation of ozone columns at the Pilot Plant.

Security personnel were constantly faced with acts of vandalism and burglary. Particularly hard hit were both of our Sewer Maintenance yards at 50th and Paschall Avenue and 1123 Adams Avenue.

Machine Shop employees continued repairing, rebuilding or modifying all water processing equipment. Besides hundreds of these jobs, the unit saved $58,676 by salvaging fire hydrants and parts.

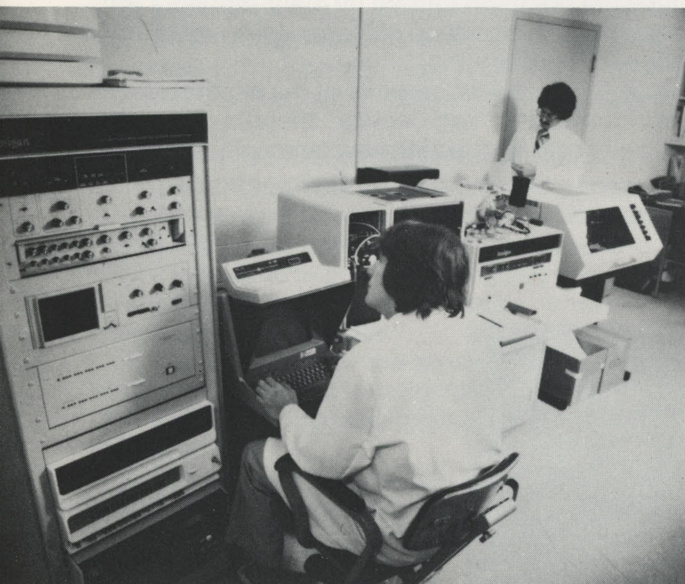
More Accurate Leakfree Meters

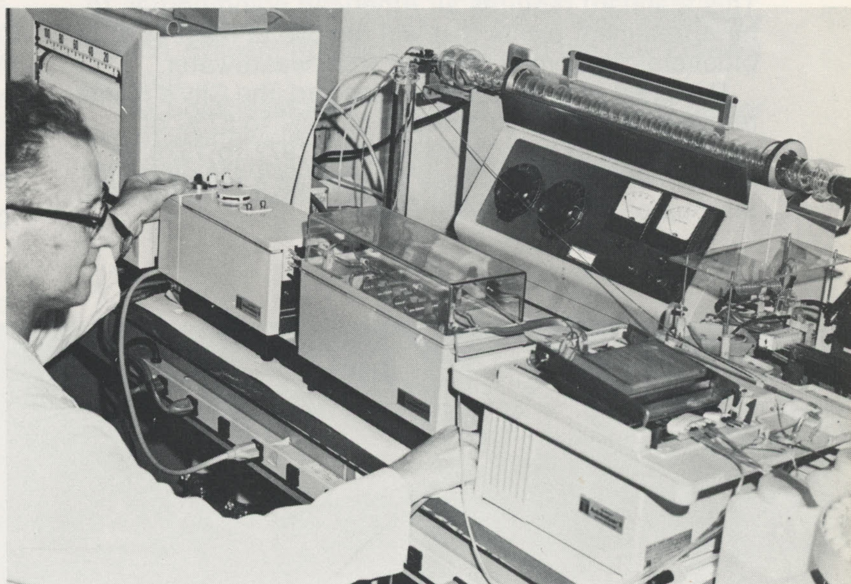
The Meter Shop continued on its 10 year program to replace 400,000 5/8 inch mechanical drive meters with those of the magnetic type. The new magnetic meters are more accurate, easier to read, less costly to repair, and are hermetically sealed so they do not leak from the register.

Residential meters are no longer repaired because it is less costly to obtain the scrap value of the mechanical meter and purchase new magnetic meters with long term warranties.

During Fiscal 1981, Meter Shop field personnel installed almost 36,700 new magnetic meters of the 5/8 inch type. Of the 429 special tests requested by customers, 100% of the meters were registering within the 2% margin allowable.

Philadelphia's Water Meets All of the Standards of the Safe Drinking Water Act





TOP: This Atomic Absorption Spectrophotometer is a sophisticated instrument used at Torresdale for trace metal analysis as required under the Safe Drinking Water Act.
BOTTOM RIGHT: Sequential automatic analyzer at Torresdale Plant rapidly checks water samples for nitrite, chloride, orthophosphate, and nitrate.
LEFT: Computer assisted Gas Chromatograph-mass Spectrometer is used to identify trace organic compounds.

The Water Pollution Control System

Old Wastewater Plants Faced With New Challenges

Though Philadelphia's old "water pollution control" plants were doing much to protect the rivers, the need for replacing them was becoming increasingly apparent in the late 1960's.

Improved many times since they were completed in the early 1960's, the plants had contributed to a gradual improvement of the Delaware and Schuylkill Rivers. New challenges in the 1970's, however, were posing new problems that the old plants were poorly equipped to meet.

1. One of these was a steady rise in wastewater flows up to Fiscal 1978 when the plants received an average of 518.8 million gallons of wastewater daily—the highest flow in their history. This was part of a long-term trend, for wastes have grown by 100 million gallons a day in 10 years.

By 1978, the flow at the Northeast and Southwest Plants exceeded rated capacities by about 30 to 50 million gallons daily, while the flow at the Southeast Plant had approached 95% of that facility's limit.

2. Although the treatment plants increased their biochemical oxygen demand removal efficiency by six percentage points from 1977 to 1978, the plants exceeded the limit set by the Commonwealth of Pennsylvania.

3. Philadelphia's plants were also unable to meet a new federal standard, which took effect on July 1, 1977. This standard requires all American communities to have treatment plants that will remove at least 85% of biochemical oxygen demand from wastewater.

Designed to meet a 1050's standard, the City's plants removed a combined average of 50% to 57% of biochemical oxygen demand from 1977 to 1979. In Fiscal Year 1981, this rose to 67% as a result of the start-up of the Southwest Plant.

New Wastewater Plants for Cleaner Streams

To provide still cleaner effluents for the Delaware and Schuylkill Rivers, the Water Department has committed itself to expand and upgrade its three water pollution control plants by 1984.

Because of inflation and new federal requirements, the cost of building these new plants has been steadily climbing. From $233 million in 1973, it rose to $414.2 million in 1976. The total construction cost for the three water pollution control plants is now estimated by the Water Department to be $874,455,000. It is divided as follows:

Southeast WPCP	$ 168,094,000
Southwest WPCP	316,042,000
Northeast WPCP	390,319,000
TOTAL	$ 874,455,000

Scheduled to be in service during the period 1980-83, the new plants will contain the latest features of the engineering art. They will remove up to 90% of biochemical oxygen demand from wastewater, or five percentage points more than federal law requires.

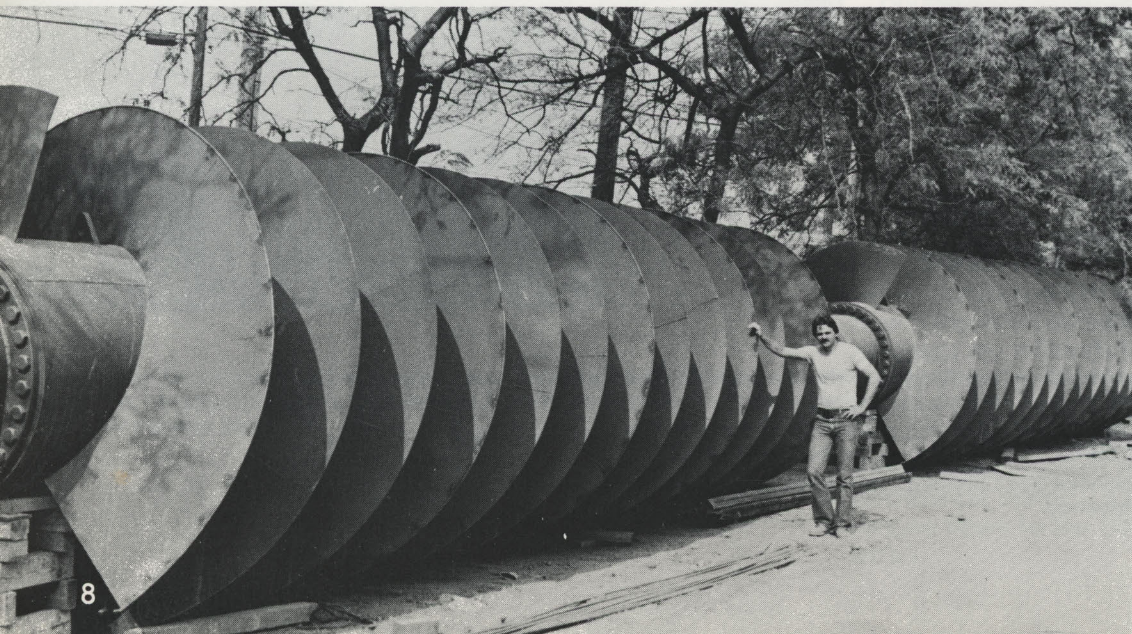
Thus, the new construction will:

• Create three activated sludge plants by upgrading the Southeast and Southwest Plants from "primary" to "secondary" treatment, and the Northeast Plant from an "intermediate" to a full secondary status,

• Incorporate into the new plants more treatment stages, more retention time for liquid wastes, and more chemical treatment, than the old plants provide,

• Reduce the pollution carried by plant effluents into the rivers to 143,120 pounds of carbonaceous oxygen demand daily—70% reduction,

• Increase the treatment capacity of the Northeast and Southwest Plants, and "regionalize" them by enabling them to accept flows from additional communities outside the city.



The Southwest Influent Pumping Station uses three of these 8.5 foot diameter, double helix, two stage screw pumps.

Southwest: A Mile Long Plant Put Into Operation

One of the busiest spots in Philadelphia in Fiscal 1981 was near the Penrose Avenue Bridge. There the Department dedicated a new wastewater plant that stretched for more than a mile towards the Delaware River.

To date, seventy contracts in excess of $154 million have started with over 145 million dollars paid against them.

Fiscal 1981 was the first complete year of full secondary treatment at the Southwest Water Pollution Control Plant. Treatment efficiencies rose to 91% removal for suspended solids and 89% removal of biochemical oxygen demand and although construction delays limited some start-up operations, these results are considered remarkable for a facility that lacks any waste sludge handling facilities.

At the heart of the complex are the concrete tanks which provide for aeration and final settling of wastewater. Within these tanks are two-story-high cells which carry the waste flow, and, deep underground, running the length of the tanks for at least a half-mile is a huge pipe and pump gallery. All of the equipment for these tanks has been installed, including controls, skimmers, sludge collectors, propeller-like agitators, and piping.

Across Enterprise Avenue on the south, the new administration building and effluent pumping station have been erected around a granite-lined court. A half-dozen mammoth pumps were installed in the pumping station, and these will eventually discharge a 90% pure plant effluent to the river, while keeping the river tide out of the plant conduits.

On the west side of the aeration tanks, a new compressor building was completed and a maze of white cylinders and pipes rose six stories high nearby. During Fiscal 1981, this complex manufactured and stored 14,841 tons of 98% pure liquid oxygen and delivered it in gaseous form to the aeration tanks, where it aided the treatment of wastewater.

On the east side of the aeration tanks, the sludge thickener building was scheduled for completion in late 1981. Eight new digester tanks were erected by the end of Fiscal 1980.

On the Penrose Avenue side of the plant, half of a new preliminary treatment was placed in operation while the other half was still under construction. Within it are huge, circular grit-collecting basins and self-cleaning screens to remove debris from incoming wastewater.

The new plant will be playing a vital regional role. It is receiving wastewater flows from western and northwestern districts of the City, and from an increasing number of outlying communities. Suburban service will expand from 38 to 128 square miles.

Although wastewater flows were exceeding the rated capacity of the old plant, the new plant will easily meet future needs:

		Millions of Gallons Daily
Old Plant	Rated capacity in Fiscal 1979	136
	Actual flow in Fiscal 1979	173
New Plant	Rated capacity in 1981	210
	Future expandable capacity if needed	285
	Actual flow in Fiscal 1981	179

The new plant will provide for complete processing of wastewater, including the screening, grit removal, air flocculation, primary settlement, oxygenation, and final settlement of liquid wastes.

Southeast Plant

During 1981, the Site Preparation Contract for the $168 million Southeast Water Pollution Control Plant was completed. Work began on the renovation of the Influent Pumping Station, Grit Transfer Station, Primary Sedimentation Tanks, Sludge Pumping Station, Grease Incinerator Station, Effluent Pumping Station and the new Effluent Conduit.

The Southeast Plant treated 118 million gallons per day of wastewater with BOD and suspended solids removals averaging 39% and 49% respectively, well within the Consent Decree requirements.

Northeast Plant

With a projected cost estimate of $390 million and a completion deadline of 1986, construction of the Northeast Water Pollution Control Plant has been complicated because it is the largest of the three plants, the existing facilities must continue to operate while they are being modified, and it is the only wastewater treatment plant located in the heart of a residential area.

Ultimately, the expanded and modified Northeast Plant will provide full secondary treatment for an estimated average annual flow of 250 MGD in 1990 as the suburban service area expands from 37 to a possible 140 square miles.

Contract work on the Frankford High Level Interceptor, Site Preparation, Electrical Building, Effluent Conduits and Modifications to Existing Treatment Tanks have all been completed. About one-half of the New Preliminary Treatment Building is complete and 20% of the New Primary Sedimentation Tanks project has been finished.

During Fiscal 1981, the Northeast Plant treated 161 MGD of wastewater, 9.6% less than in Fiscal 1980. Although construction created many plant operating problems, the National Pollutant Discharge Elimination System permit regulations were met for the Suspended Solids Reduction for pounds of BOD load to the Delaware River per day, but not for the BOD percent removal.



Over 75 contractors were involved in the construction of the $316 million Southwest Plant.

Ending Ocean Dumping

The City's wastewater plants are currently producing 190 dry tons of digested sludge daily, and, with the expansion and upgrading, they can be expected to produce almost double that quantity within the next decade or so.

This sludge, the end product of wastewater treatment, had been barged to the Atlantic Ocean by the Department since 1961 and deposited in a site 50 nautical miles southeast of Delaware Bay. With the cessation of ocean disposal of sludge on November 24, 1980, a new era in Philadelphia's Sludge Management Program began.

During Fiscal 1981, 38,279 dry tons of sludge cake/composted mixture was used to reclaim over 760 acres of exposed strip mine land in Western Pennsylvania. Continued environmental monitoring on all sites reclaimed to date has shown no adverse effects on water, soil, or vegetation. This fact, coupled with an active public information program, and meetings with local officials and land owners has generated continued public acceptance.

Approximately 8.97 million gallons of liquid digested sludge, 72% more than in Fiscal 1980, were applied on farms as well as state and city owned lands.

Screened material called "Gardenlife" was marketed under a concession agreement and distributed last year to local garden and retail stores. Promotions of the product did not reach expected proportions but a new five year concession agreement is expected to improve the contractor's marketing commitments.

A new process, which was developed by Franklin Institute Research Laboratory, will be tried out at the Northeast Plant. There, sludge cake will be fused with incinerator ash to produce a construciton material, Eco-Rock, for highways. Construction of the $3 million Eco-Rock Demonstration Plant, 85% of which is funded by EPA, began during the week in Fiscal 1981. Start up of the Plant is expected in Spring of 1982.

Infiltration/Inflow Study

Because wastewater flows will increase in future years, the Department has been studying how to eliminate unnecessary inflow of storm water into sanitary sewers and the excessive infiltration of ground water into both sanitary and combined sewers.

This Fiscal Year, the Department reviewed the consultant's final reports on Infiltration/Inflow and submitted them to the regulatory agencies for final approval.

In the Southwest, Southeast, and Northeast drainage districts, over 9,000 manholes and 50,000 feet of sewers were investigated to locate sources of rain induced inflow. Television cameras inspected another 365,000 feet of sewer for infiltration.

The I/I Study had indicated that Philadelphia can eliminate 6 million gallons per day (MGD) infiltration and inflow in the Southeast drainage district with a recommended $2.0 million rehabilitation program. In the Southwest district, a $315,000 repair program will reduce flows to the Southwest Treatment Plant by 11.5 MGD.

Combined Sewer Overflow Program

Overflows to streams from sewer regulating chambers account for 15% of all City effluent entering the rivers. By 1990, however, this could rise to 35% because of increased wastewater generated by Philadelphia and outlying communities.

These overflows originate in 1,600 miles of "combined" sewers, which carry sanitary wastes and storm water in the same pipe. In dry weather, the chambers direct all this flow to treatment plants, but in time of storm, they bypass a small portion of it to the rivers.

Over the past five years, the department has been developing a plan for the automation of its sewer regulating chambers. Automation could cut in half the wet-weather overflows and eliminate accidental discharges at other times.

This year, the first prototype of an automated regulator was placed into service at Dark Run Lane where it is controlled by a computer at the Northeast Plant. Two other prototypes are in the final stages of completion and twelve other sites are being planned.

Sewer Construction

Other improvements were made this year to the sewer network. During the year, contractors built 8 miles of sewers compared with 9 miles the year before. The new lines were intended to relieve insanitary conditions, service new homes and industrial tracts, and replace old sewers. Total sewer mileage on June 30, 1981 was 2,927 miles.

Wastewater Pumping

As part of a general improvement, automation has also been planned for the Central Schuylkill Pumping Station. This station, which is situated on the west bank of the Schuylkill River, receives wastewater from the east bank and lifts the flow into an intercepting sewer that supplies the Southwest Plant. Under contracts totaling over $581,500.00, the Department began replacing four of the old wastewater pumps in Fiscal 1980. The new pumps have a capacity of 40 million gallons daily each. The work which was completed in Fiscal 1981, also includes new pump motors, speed controllers, a manlift, and a new control system for future automation.

New Sewers To Reduce Storm Flooding

The construction of new houses and paved surfaces on open fields has caused increased storm runoff in the past 100 years. As a result, many old sewers that were build in the 19th century are unable to carry today's heavier storm flows.

To reduce the resultant flooding, Philadelphia has spent $45.6 million for large relief sewers since 1973 and it will invest another $109 million for additional flood control projects to 1988. This figure is exclusive of sums normally invested each year in improving small storm water sewers.

This work continued in Fiscal 1981. The Water Department put under way or announced six large projects to relieve storm flooding in various parts of the City with a combined limit of $31.8 million.

Belfield Avenue Relief Sewer

At a combined projected cost of approximately $17 million, two contracts are underway to reconstruct sections of the large Belfield Avenue Sewer, to help relieve storm flooding in that vicinity west of Broad Street.

Following an old stream bed, the Belfield Sewer is the main run of a stormwater drainage shed of over 5,000 acres, which eventually empties into Tacony Creek.

Examination of the physical condition of the structure indicated overall deterioration, especially where the large Ogontz Branch junctures with the Belfield Sewer near 18th Street.

Reconstruction was necessary where the crown was collapsing between 18th Street and Wister Avenue. About 3,300 feet of a 13 x 22 foot reinforced concrete sewer replaced the deteriorated 9 x 6 foot brick sewer. Another 1500 feet of 15 x 20 foot of R C Twin sewer will be constructed between 15th Street and 16th Street.



Contractors built 8 miles of sewers during Fiscal 1981 bringing the total sewer mileage to 2,927 miles.

Thomas Run Relief Sewer

The Thomas Run Sewer System has been a cause of frequent flooding in the West Philadelphia area. The system, including its branches, extends for nearly five and one-half miles, draining an area of 1,113 acres from 49th Street to 61st Street and from Vine Street to Springfield Avenue.

This system was built over 85 years ago when much of West Philadelphia was farm land or small communities. It was never designed to carry heavy storm run off from paved streets, parking lots, and thousands of roofs and driveways. The new sewers constructed under this contract will help to correct the situation.

The $10 million Thomas Run Relief Sewer consists of two parts and is expected to be completed late in 1982. The first part, 3,300 feet, extends from Webster Street to Locust Street, and will be in an 11 foot diameter tunnel section at approximately 40 feet in depth. The second part will extend 930 feet from Locust Street to Chestnut Street and will be constructed as a 7 x 11 foot box section in open cut. A portion of the tunnel has been bored out by utilizing a tunnel boring machine. The work on the box culvert is progressing to Sansom Street.

In addition to the tunnel and box culvert, this contract includes the construction of several deep well holes that will reach deep into the tunnel and two large interceptors, which will connect the tunnel portion with the box culvert portion.

Upper Schuylkill - East Side

In August of 1980, reconstruction of nearly 100 year old sewer was begun in East River Drive, north of the Gustine Lake Interchange.

At a cost of more than $3.5 million, the new 8.5' x 4.0' box sewer will help in alleviating the overload in handling sewage from a large part of the Northwest Section of the City. The project is expected to be completed in the summer of 1983.

Additions to Mingo Creek Pumping Station

Recent expansion and growth in the Philadelphia International Airport, "Cargo City," and Southwest Philadelphia areas has created a tremendously large increase in the amount of rainwater run off. Subsequent flooding of large portions of this immediate area necessitated a swift remedy. In 1980, the department completed construction of the Mingo Creek Surge Basin, a storm water holding facility approximately one mile in length, one hundred to two hundred-fifty feet in width, by approximately fifteen feet in depth.

To accommodate the flow of this new man-made course, the Water Department is building a new additional section of the most recently built Mingo Creek Pumping Station.

The facility will be complete and fully operating by the Spring of 1982, providing a pumping capability of three times that of the 1950's station, with a total of six 500 horsepower electrically-driven, sonically-sensored, storm water pumps and two 50 horsepower ground water pumps. The new total capacity will be capable of moving the flow produced in the basin by a "One Hundred Year" intensity type storm (the most severe storm in a one hundred year period). This facility, in conjunction with the Mingo Creek Surge Basin, will provide efficient, automatic storm water control for many years to come.

Sewer System Maintenance

With 2,927 miles of sewers to maintain in the City, the Water Department has adopted new techniques in recent years. Television cameras inspect sewers too small for a man to crawl through; high pressure water jets cut through blockages; special machines vacuum-clean inlets; a computer records inlet cleaning jobs.

Sewer Maintenance

To keep wastes flowing through the city sewers, maintenance crews performed 16,774 jobs. They walked or crawled through 201 miles of sewers and checked another 8 miles by television camera.

Crews also cleaned 35 miles of sewers by high pressure flusher and 2 miles by mechanical bucket. They rodded 3 miles of choked sewers and inlets, and cleaned 53 acres of streams and their banks.

Jobs performed by the crews on the inspection, repair, cleaning or reconstruction of various facilities included:

Jobs	Fiscal 1981	Fiscal 1980
Sewers	7,206	11,957
Inlets	8,992	5,187
Manholes	331	376
Laterals	29	46
Drainage Rights-of-Way	216	228
	16,774	17,794

Inlet Cleaning

Since 1968, when the job of cleaning 75,000 sewer inlets was transferred from the Streets Department to the Water Department, crews have responded to hundreds of thousands of requests for service. The responsibility of cleaning and maintaining 537 inlets in Fairmount Park was added in 1972.

Cleaning 66,400 inlets, crews removed 1.4 million cubic feet of debris. This would have filled the playing field of Veterans Stadium to a height of 41 feet.

Missing or stolen inlet covers has become a problem to the department. Besides wasting countless manhours, these hazardous situations cause pedestrian accidents which become expensive law claims against the City. In Fiscal 1981, crews replaced 6,634 covers. The cost of replacement of these expensive metal covers ran into thousands of dollars. The use of round concrete inlet covers has proven successful in areas where metal covers are frequently stolen.

Because of the expansion of the Northeast Water Pollution Control Plant, Inlet Cleaning Headquarters were moved to a temporary location at 1123 Adams Avenue.

Industrial Waste Control

In Fiscal 1981, inspectors collected 1,185 composite grab samples as a basis for levying $2.3 million in surcharges on industrial wastes whose strength was above the specified limit. The industrial surcharge, authorized under a 1977 ordinance, imposes strict limits on the discharge of heavy metals, oils, greases, and other substances by Philadelphia industries to help the City meet federal standards for wastewater plant effluents, improve sludge quality for land disposal, and protect the department's plants from treatment upsets.

In addition to advising industries how to neutralize or contain wastes, the Industrial Waste Unit began monitoring programs in 1977 and negotiating with individual firms as the first stage in enforcement or these negotiations. Several injunctive actions during Fiscal 1980-81 resulted in obtaining court-witnessed consent decrees.

The Environmental Protection Agency granted approval last year of the Department's Industrial Waste Pre-treatment program. One of first approved nationwide, it permits the flow of construction grant monies to continue for plant expansion projects.

Finally, industrial waste engineers investigated hundreds of complaints of oil and chemical spills, and also abandoned containers of waste chemicals. Once a source was found, the discharger was compelled to properly dispose of the waste. If they did not take action, sizeable bills for the department's work served as a future deterrent.



The city's 75,000 inlets are a constant challenge to clean-up crews. Many can be cleaned by crane; others require a special vacuum truck (below).



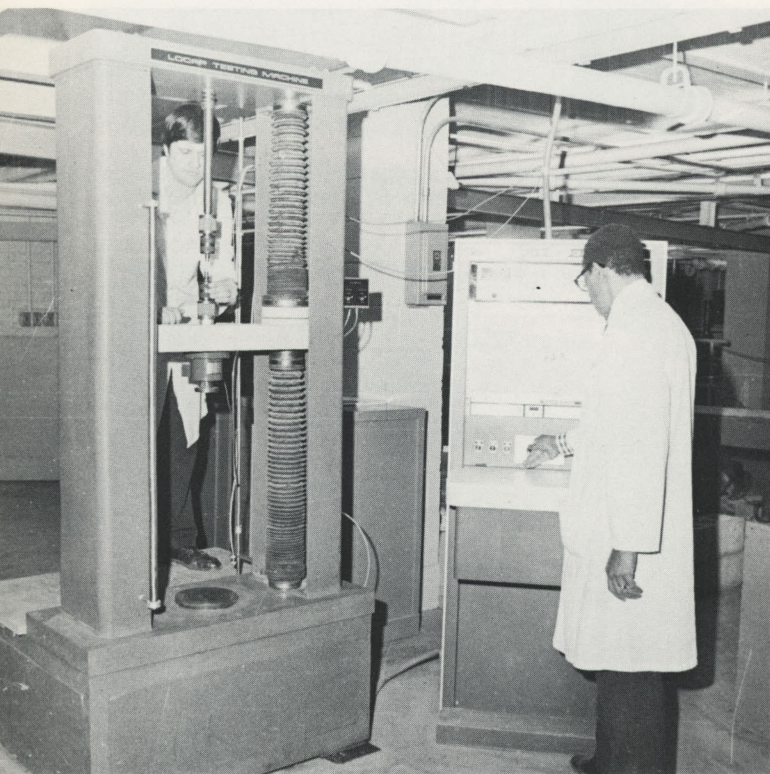
Engineering Services

Design

Plans, specifications and estimates for 120 projects, valued at $39 million, were prepared by the Design Branch. The projects included a huge storm flood relief sewer, replacement of filter bottoms at two water treatment plants, a lime grit removal system, emergency chlorine scrubber, water pollution control plant expansion projects, and many miles of distribution mains and sewers.

Construction

As required by the Federal Water Pollution Control Act of 1972, the Water Department is currently expanding its three Water Pollution Control Plants. Due to this $880 million Water Pollution Abatement Program, Construction Branch engineers were busier than ever before. In Fiscal 1981, engineers supervised 385 contracts with a combined limit of $539 million. Of these, 218 with a limit of $405 were active, while 167 contracts worth $134 million were completed during the year.



The Materials Testing Laboratory uses this 30,000 pound capacity LOCAP testing machine to check the tensile and compressive strength of metals purchased by the City.

Materials Testing Laboratory

The Materials Testing Laboratory continued in Fiscal 1981 to provide engineering testing and consulting services to several units within the Water Department and to various other departments and agencies of the City of Philadelphia. The laboratory performed 178,564 tests on 11,461 samples of material used in major construction projects, for maintenance of City facilities, and a general City supplies. This testing, a 17% increase over the previous year, helped insure that the City of Philadelphia received safe, satisfactory and specified products.

An outstanding example of the innovative engineering developed at the laboratory is the wear and life expectancy tests for water meters. Prior to this past year, the accepted tests in the water utility industry had only been for the accuracy of each manufacturer's water meter.

Planning and Technical Services

The Planning and Technical Services Division is responsible for strategic planning, research, computerized information systems and laboratory services for the Water Department.

In addition to creating three satellite laboratories for water, wastewater, and materials testing in 1981, the new Bureau of Laboratory Services (BLS) established a Projects Section for assessing the quality of water and wastewater services provided by the operating division and a Quality Assurance Section to review the BLS's internal testing procedures and insure that the laboratory achieves appropriate certification requirements.

Planning and Technical Services also played an important role in helping to place the "Management by Objectives" (MBO) concept into practice as it is sought to establish department-wide programs for energy management, the reduction of non-revenue producing water and a drought water emergency plan.

To assist with the MBO concept, the Data Management Center concentrated on developing a comprehensive management information system which would report expenditures to appropriate managers for approximately fifty functional units located throughout the department. The reporting structure of this budget accounting system is designed to generate account balance reports for each of five levels of management within the Water Department.

Management and Fiscal

Personnel Developments

While continuing to provide tuition reimbursement for engineers taking certain courses,t he department also trained its managers in advanced management techniques such as "management by objectives" and "zero based budgeting". Other sessions included the Mechanical Trades Training Program, Cardiac Pulmonary Resuscitation (CPR), First Aid, and Confined Space Entry Procedures. In addition, the Personnel Office worked closely with the City Employees Counseling Unit to develop a new model for dealing with employees who suffer behavioral or emotional problems which prevent them from performing satisfactorily on the job.

On January 1, 1981, after considerable testing, the computerized employees attendance records keeping system took the place of the old manual system for all units.



New and Old: Operator on left uses CRT terminal connected to Computer Center while employee on right uses outmoded bookkeeping machine that is being phased out.

Safety

The frequency rate for disabling injuries per million man hours worked rose in 1981 to 37.33 from 32.48 in 1980. Actual days lost because of injury decreased to 1369 from 2037 in 1980.

To reduce such injuries, the Safety Office instituted a safety meetings program held on a regular basis with the Safety Officers providing technical assistance.

Employees were involved in 173 vehicle accidents during 1981 compared to 170 in 1980. To reduce such injuries, the department developed a motor vehicle accident review procedure and a system of checking vehicle operator's licenses.

Fiscal Unit

The Fiscal Unit of the Administrative Division is responsible for budget preparation and control, cost accounting, plant investment records, and water and wastewater rate development.

Financial Highlights

Because of limited space, the complete 21 page financial report cannot be reproduced here. However, on the next two pages, we are presenting three schedules which present the reader with an understanding of the magnitude of the Fiscal operation.

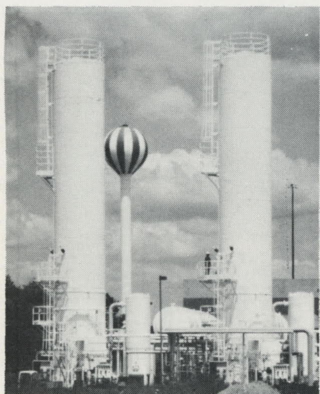


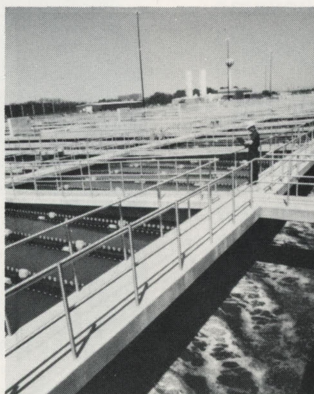
An employee at the Engineering Computer Center enters instructions on the HP 3000 acquired in 1975. Memory units in background each store up to 94 million characters. Secondary storage in the Center now totals 500 million characters.

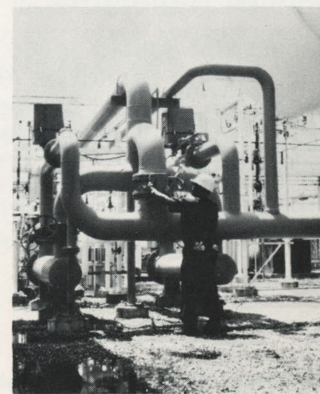
City of Philadelphia Water Department—
Administering The Water and Sewer Funds

CONSOLIDATED SUPPLEMENTAL SCHEDULE OF RATE COVENANT COMPLIANCE FOR THE FISCAL YEAR ENDED JUNE 30, 1981 AND 1980 (Amounts in Thousands of Dollars) (Legally Enacted Basis)

LINE NO.		1981	1980
	PROJECT REVENUES:		
1.	Water	$ 55,540	$ 55,416
2.	Wastewater	77,507	81,525
3.	Total	133,047	136,941
	OPERATING EXPENSES:		
4.	Water	44,453	43,142
5.	Wastewater	49,919	35,576
6.	Total Operation and Maintenance Expenses	94,372	78,718
7.	Less - interdepartmental charges	(7,456)	(7,059)
8.	Net operating expenses	86,916	71,659
9.	Net earned project revenues	46,131	65,282
10.	Unencumbered funds available for appropriation at beginning of fiscal year	15,121	3,012
11.	Adjusted net project revenues	$ 61,252	$ 68,294
	DEBT SERVICE:		
	Revenue bonds debt service:		
12.	Principal	$ 5,130	$ 3,340
13.	Interest	26,529	26,507
14.	Less - Interest capitalized	(3,905)	(9,718)
15.	Total revenue bonds debt service	27,754	20,129
	General obligation bonds debt service:		
16.	Principal	14,628	14,622
17.	Interest	7,198	7,686
18.	Total general obligation bonds debt service	21,826	22,308
19.	Total debt service	$ 49,580	$42,437
	OTHER CHARGES:		
20.	Interdepartmental charges	$ 7,456	$ 7,059
21.	Total revenues and beginning unencumbered balance (Line 3 + 10)	$148,168	$ 139,953
22.	Total operating expenses, debt service and other charges (Line 8 + 19 + 20)	143,952	121,155
23.	Net unapplied project revenues	4,216	18,798
24.	Funds transferred to General Fund	4,000	3,677
25.	Unencumbered funds available for appropriation at end of fiscal year	$ 216	$ 15,121







OUR COVER (LEFT): Two cryogenic oxygen units rise six stories high with elevated water tank in background at the Southwest Plant. INSIDE COVER (CENTER): Operator checks final sedimentation tanks at Southwest Plant. BACK COVER (RIGHT): Maintenance mechanic checks a valve near liquid oxygen storage tanks.

City of Philadelphia Water Department—
Administering the Water and Sewer Funds

CONSOLIDATED SUPPLEMENTAL SCHEDULE OF RATE COVENANT COMPLIANCE FOR THE FISCAL YEAR ENDED JUNE 30, 1981 and 1980 (Amounts in Thousands of Dollars) (Legally Enacted Basis)

Pursuant to Section 4.03 (b) of the General Water and Sewer Revenue Bond Ordinance of 1974 (Bill No. 1263), the City is required to impose, charge and collect in each Fiscal Year rates and charges at least sufficient, together with that portion of the unencumbered amount of the operating funds balances available and reserved for appropriation of the payment of Operating Expenses at the commencement of such Fiscal Year, which together with all other project revenues to be received in such Fiscal Year, shall equal not less than the greater of:

A. The sum of:
  (i) All Net Operating Expenses payable during such Fiscal Year;
  (ii) 150% of the amount required to pay the principal of and interest on all Bonds issued and outstanding hereunder which will become due and payable during such Fiscal Year; and
  (iii) the amount, if any, required to be paid into the Sinking Fund Reserve during such Fiscal Year; or

B. The sum of:
  (i) all Operating Expenses payable during such Fiscal Year; and
  (ii) all Sinking Fund deposits required during such Fiscal Year in respect of all outstanding Bonds and in respect of all outstanding general obligation bonds issued for improvements to the water or sewer systems and all amounts, if any, required during such Fiscal Year to be paid into the Sinking Fund Reserve.

Coverage is computed as follows:

	1981	1980
Coverage A		
Line 3	$133,047	$136,941
− Line 8	(86,916)	(71,659)
+ Line 10	15,121	3,012
	61,252	68,294
+ Line 15	27,754	20,129
= Coverage	2.21x	3.39x
Coverage B		
Line 3	$133,047	$136,941
− Line 6	(94,372)	(78,718)
+ Line 10	15,121	3,012
	53.796	61,235
+ Line 19	49,580	42,437
= Coverage	1.09x	1.44x

Water and Sewer Funds Historical Cost of Utility Plant in Service and Under Construction Fiscal Years Ended June 30, 1981 and 1980

	(In Thousands) 1981	1980
Total Property, Plant and Equipment at beginning of Fiscal Year	$1,155,149	$1,072,348
Capital Expenditures For The Fiscal Year	148,446	82,801
Total Property, Plant and Equipment at End of Fiscal Year	$1,303,595	$1,155,149

Note: This schedule depicts the magnitude of the Water and Sewer Utility Plant in Service and Under Construction.

Water and Sewer Funds Long Term Debt Obligations Fiscal Years Ended June 30, 1981 and 1980

	(In Thousands) FY '81	FY '80
General Obligation Bonds	$ 173,375	$ 188,003
Revenue Bonds	487,360	492,490
Total Debt Service	$ 660,735	$ 680,493
Sinking Funds and Reserves Held by Fiscal Agents	68,979	77,822
Sinking Funds Applicable To General Obligation Bonds	2,733	2,547
Total Provision For Redemption	$ 71,712	$ 80,369
Long Term Debt Outstanding	$ 589,023	$ 600,124

